Editorials

Magnetic Resonance in Medicine

ALTHOUGH nuclear magnetic resonance (MR) was first described in the late 1940s almost simultaneously, but independently, by Bloch[1] of Stanford University and Purcell[2] of Harvard University, the technique was applied only in analytic chemistry for two and a half decades. Following the discovery of computed x-ray tomography, Lauterbur[3] of New York in 1973 published a paper indicating the possibility of generating three-dimensional images by a method that allowed the localization of radiofrequency signals within a volume. Very rapidly thereafter, important developments took place [4,5] and within a span of years we were able to see images with surprising degrees of spatial and contrast resolution. This newly emerging imaging technology was applied first to the central nervous system, which was not unique to magnetic resonance for the same was true of other important developments in imaging technology. For instance, cerebral angiography developed before angiography of other organs; ultrasound was first described in its applications to the brain; radionuclide brain scanning was also described early for the detection of brain tumors, and, of course, x-ray computed tomography was first applied to the brain. This is partly because it is difficult to examine the brain by external means and because the brain does not move and is very frequently involved in pathologic processes of all types. Thus, the article by Kucharczyk and coauthors appearing in this issue is very much in keeping with this tradition. To be sure, magnetic resonance is being applied to other organs in the body: the abdominal organs, the chest—including the mediastinum and particularly the heart—and also to the soft tissues and bones of the extremities. However, there are a number of technical difficulties in imaging the abdominal organs and the thoracic cavity due chiefly to the presence of respiratory and pulsatile motion, which tends to degrade the images. Much work is going into solving this problem, and techniques are being worked out to obtain images with gating of the heart via electrocardiographic control and gating for respiration. The latter is somewhat more difficult but I have confidence in their ultimate solution.

If we apply our relatively recent experience with x-ray computed tomography (CT), we can predict that there will be a slower development and a relatively slow learning curve for all of us in all areas outside of the central nervous system. CT made its appearance in the United States in the summer of 1973 and by the end of 1974 it was well established as a method of examining the brain. However, three years later, in 1977, we still did not have approval for payment of body CT examinations by the Health Care Financing Administration and most third-party payers, as its usefulness in body imaging was still in question.

Although MR clinical images of the brain were only obtained a little more than four years ago, we already count on systems capable of excellent spatial and density resolution.[6] It has also been shown that in the central nervous system, magnetic resonance imaging is already superior to CT in a significant number of areas. It is probably the method of choice to examine infants and children because of the absence of ionizing radiation and because of the ability of magnetic resonance to depict soft tissue detail much better than CT. For instance, the degree and the progress of the myelinization process in infants can easily be shown by MR but cannot be evaluated by CT. Thus, I believe that MR is ready for clinical application and that individual patients and third-party payers should accept this new modality in the special areas where it has been shown to be superior to CT. This list includes most areas with the possible exception, at the moment, of acute trauma, uncooperative patients, patients who carry cardiac pacemakers and seriously ill patients who may need life-support measures. In this last category, however, the problem can be solved by keeping the metal objects outside the room and bringing only hoses and wires into the magnet room.

ABBREVIATIONS USED IN TEXT

ATP = adenosine triphosphate
CT = computed tomography
MR = magnetic resonance

One of the more attractive features of magnetic resonance is the potential for obtaining images of other elements such as sodium, phosphorus and fluorine. Indeed, images of sodium have already been obtained and the increase in the sodium content in a recently ischemic area of the human brain has already been shown.[7,8] It is also possible to obtain in vivo spectroscopy, which has been termed topical magnetic resonance. These in vivo phosphorus spectra can show rapid changes in the energy metabolism of the tissues by demonstrating adenosine triphosphate (ATP), creatine phosphate, inorganic phosphate and sugar phosphate. In animals it can be shown that rapid changes do take place in inorganic phosphate, creatine phosphate and ATP in brain ischemia and it can be expected that this procedure will be applicable to the human brain within a short period of time. Considerable interest has been aroused by the possibility of doing proton chemical shift imaging. The term is applied to the observation that protons produce different spectra depending on the place in a molecule where they are located.

It is already apparent that magnetic resonance is the procedure of choice to examine a patient who may have brain or spinal cord disease of a subacute or chronic nature and, with some exceptions, in acute conditions in cooperative patients. This includes infants and children who may require some sedation. In a consecutive series of cases of brain tumor examined at the Massachusetts General Hospital, magnetic resonance was capable of detecting the presence of intracerebral tumors in 100% of symptomatic patients, whereas computed tomography detected only 94% of lesions in the same group.

In general, physicians try to offer their patients the best in their judgment without regard to costs and they prefer the safest possible method to arrive at a diagnosis. Concerns for the rising costs of medical care may well delay the introduc-

tion of MR into daily practice, but it is hoped that the American traditions for allowing patients to receive the best that science has made available will prevail. Obviously, if physicians conclude, after careful study and evaluation, that MR is the method of choice to detect and characterize certain diseases, it should be used in preference to other approaches. This perhaps should be considered a patient's right.

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The Need to Support Organized Medicine

AS WE ENTER the second half of this decade one senses an impending economic crunch for physicians and patient care. Forces, seemingly beyond any control, are rampant in health care and significant economic pressures are already affecting both physicians and patients. Issues of economic survival in practice seem likely to affect many physicians and issues of rationing of care seem likely to affect many patients. Already some practicing physicians have noted reduction in their incomes, and this in the face of rising costs over which they have little or no control. Some patients are beginning to experience de facto rationing of care in some of the health care programs in the West, and elsewhere. And, to be candid, we probably "ain't seen nothin' yet." Realistically, it is likely that things will get worse before they get better, since the supply of dollars available for patients is not and never will be adequate to meet all of an ever-increasing demand.

What to do? Frustrated and feeling powerless, and sensitive to a personal economic pinch, some physicians understandably feel that somehow their leaders and their dues-supported organizations should not have allowed all this to happen; and since it is now happening, they should be doing something more about it. A present danger is that physicians who are frustrated, resentful and perhaps under some economic stress, will tend to withdraw their support of organized medicine just at the time when they need it most and it needs them most. If individual physicians or organized medicine are "to do something about it," all should rally around and individually and collectively identify what needs to be done and then do it. What is needed is more support by physicians for organized medicine and for each other—not less. A scattering or fragmentation of physicians at this time cannot be in either their individual or professional interest. Nor will it be in the interests of patients who will need the individual and collective advocacy of their physicians and organized medicine as never before.

The reality is that medical associations and organized medicine were never in a position to prevent either the rising costs of health care nor the rising concern among the public and private payors of these costs. Nevertheless, individual physicians and the organized profession can now "do something about it" in many ways. They can help to eliminate unnecessary costs and improve efficiency in health care delivery. This they can do, should do and are doing; already there is much being accomplished. But in the final analysis, when one gets to the bottom line of a limited number of health-care dollars and an ever-increasing public need and demand for health care services, one can see that there will be inescapable pressures to reduce the number and quality of health-care services that are rendered. It is here at this bottom line of health care that individual practicing physicians and physicians collectively in their professional organizations must stand and be counted. And it is here that individual physicians and their professional organizations will need the active support of all physicians in their own and their patients' interests.

To paraphrase an old expression, "Now is the time for all good physicians to come to the aid of their medical associations" in order to protect, preserve and promote adequate patient care of good quality. Membership retention and membership recruitment are now more urgent than ever before. This is essential, and clearly in the economic interest of all concerned.

MSMW

Polyamines in Biology and Medicine

VIRTUALLY ALL eukaryotic cells contain significant amounts of the polyamines spermidine and spermine and their precursor, putrescine. Although the specific physiologic functions of these polyamines are still not well understood or well defined at a molecular level, extensive recent studies have shown that their concentration is highly regulated and that cellular proliferation and differentiation require polyamine biosynthesis.[1-3] The availability of new reagents for specifically modulating the polyamine pathway has led to a tremendous resurgence in investigations of the fundamental role of these polycations and of the therapeutic efficacy for selectively blocking the synthesis pathway.[2-4]

The interdepartmental conference at the UCLA School of Medicine on "Polyamines in Clinical Disorders" presented in this issue is very timely and provides a brief overview of the polyamines, their synthetic pathway and the potential significance of polyamines in the physiologic function of many body organ systems. The conference participants discuss the potential clinical applications of inhibitors of polyamine biosynthesis in neoplastic disorders, pulmonary oxygen toxicity and skin disorders including psoriasis. The authors underline the fundamental importance of polyamine metabolism in cell function and describe the biologic clues suggesting the relationship of normal and altered polyamine metabolism to clinical disorders.

The role of polyamine biosynthesis in the proliferation of tumor cells is receiving renewed attention, and manipulation of this pathway for therapeutic purposes is a much-sought-after goal.[2-4] Dr Marton provides extensive evidence that the inhibition of polyamine synthesis influences the cytotoxicity